Missoula

Blasting & Explosives

)A Forest Service • Technology & Development Program • 6700 Safety & Health

Jim Tour
Project Leader/Technical Advisor

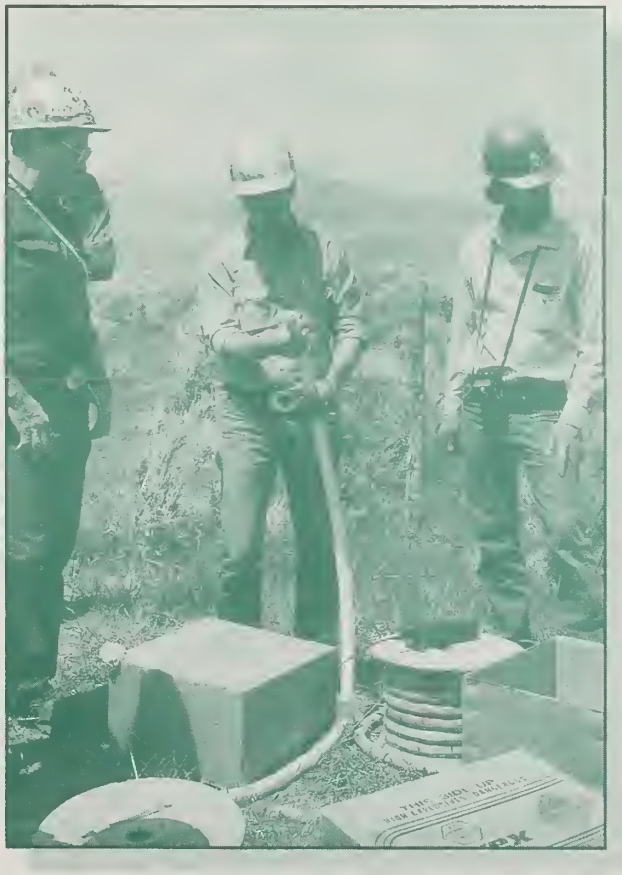
Jim Tour is a Project Engineer at MTDC, specializing in explosives and incendiaries. Jim began working for the Forest Service in 1970, spending 8 years as a technician at the Technology and Development Center in San Dimas, California. He received his degree in mechanical engineering at California Polytechnic Institute Pomona, and came to MTDC shortly afterward. Jim helped develop the Premo MK III aerial ignition device and has helped redesign the helitorch.

Technical Services—Explosives

TE02L14

The Missoula Technology and Development Center (MTDC) serves as the technical advisor for the Forest Service Blasting and Explosives Program. Through Explosives Technical Services, MTDC serves as a clearinghouse for information and works closely with the Forest Service Regional Blaster Examiners and Coordinators. This project provides technical help to Forest Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and several State agency field units.

Technical Services helps Regional Blaster Examiners conduct workshops and demonstrations of new equipment and explosives. A national workshop is conducted annually to discuss the latest technology in blasting and explosives techniques. In addition, MTDC maintains an approved explosives and accessory list, and provides a forum for answering inquiries from field personnel concerning equipment, techniques, and new rules and regulations. MTDC also represents the Forest Service as a member of the Society of Explosives Engineers.



Workshops help MTDC provide information on new products.

Emulsion explosives can be used to remove hazard trees.

Testing is an ongoing part of MTDC's Explosives Program. Here, fireline explosives are being tested.

Current Publications

Forest Service Manual (FSM 6745) Safety and Health Activities–Blasting and Explosives. This manual provides the authority for storage, use, and transportation of explosives. It delineates the objectives, policies, and responsibilities in the Forest Service Blasting and Explosives Program and sets the standards and procedures for certification.

Blaster's Guide for Using, Storing, and Transporting Explosives and Blasting Materials. Forest Service and other land management agencies rely on this comprehensive guide. It is designed to ensure the safe storage, transportation, and use of explosives by qualified personnel. The guide includes the latest information on water gels, emulsions, detonating cord, ammonium nitrate and fuel oil (ANFO), and nonelectric (Nonel) detonation systems. Fireline, avalanche, and seismic work are addressed. This guide (available in limited quantities) is in the process of being updated for distribution in Fiscal Year 1999.

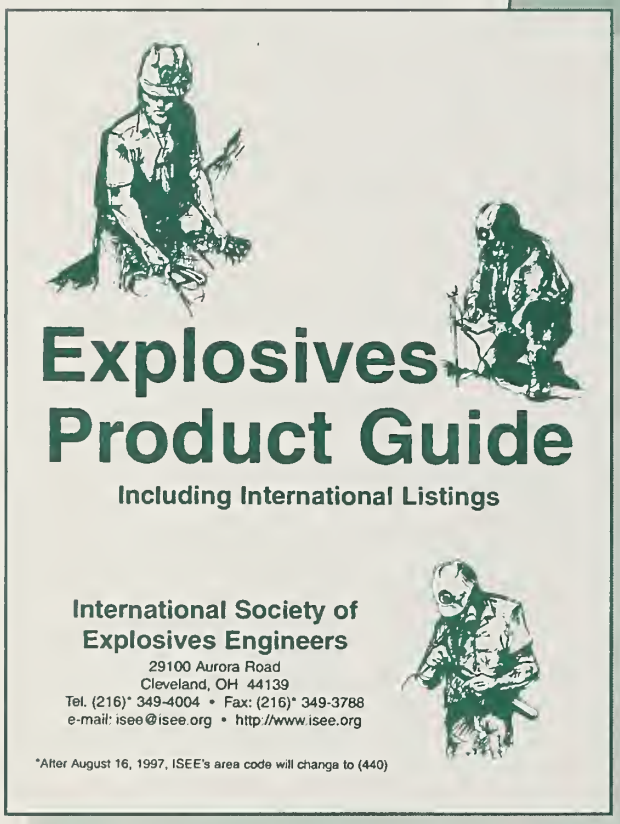
The basic guide for Forest Service employees that use explosives.

Placard used when transporting explosives.

Approved Explosives and Accessories List

This listing of Forest Service-approved explosives and associated equipment is kept current by testing new and revised products, such as the remote detonation system, nonelectric detonation systems, and shape charges. Contact MTDC or a Regional Blaster Examiner for the latest copy of the list.

The range of products investigated by the MTDC Explosives Program.

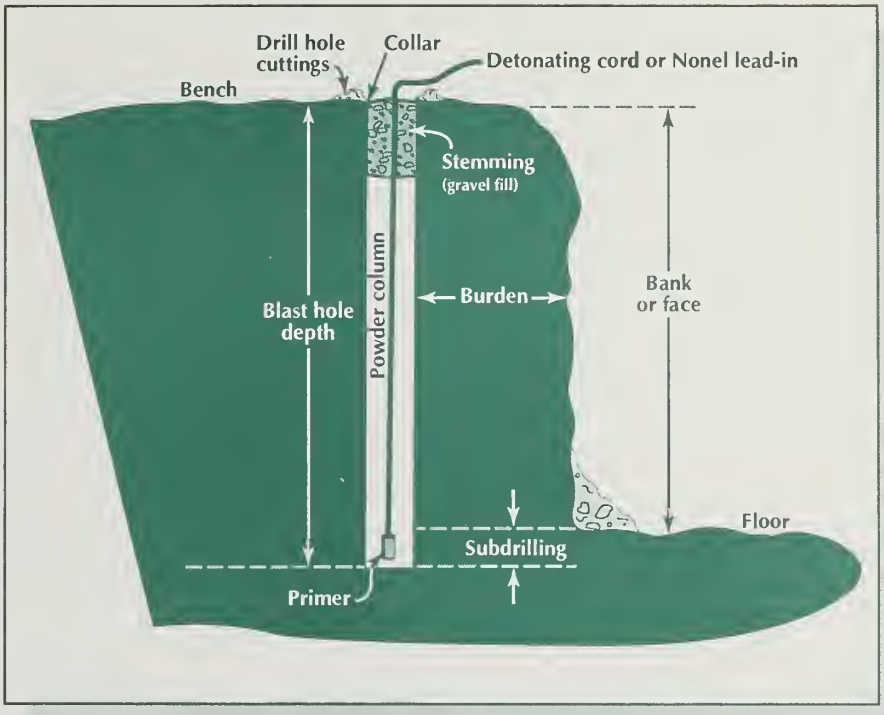


The Explosives Product Guide helps Blasters select appropriate products for their projects.

Two approved brands of fireline explosives.

ER/COR Training for Contract Blasting

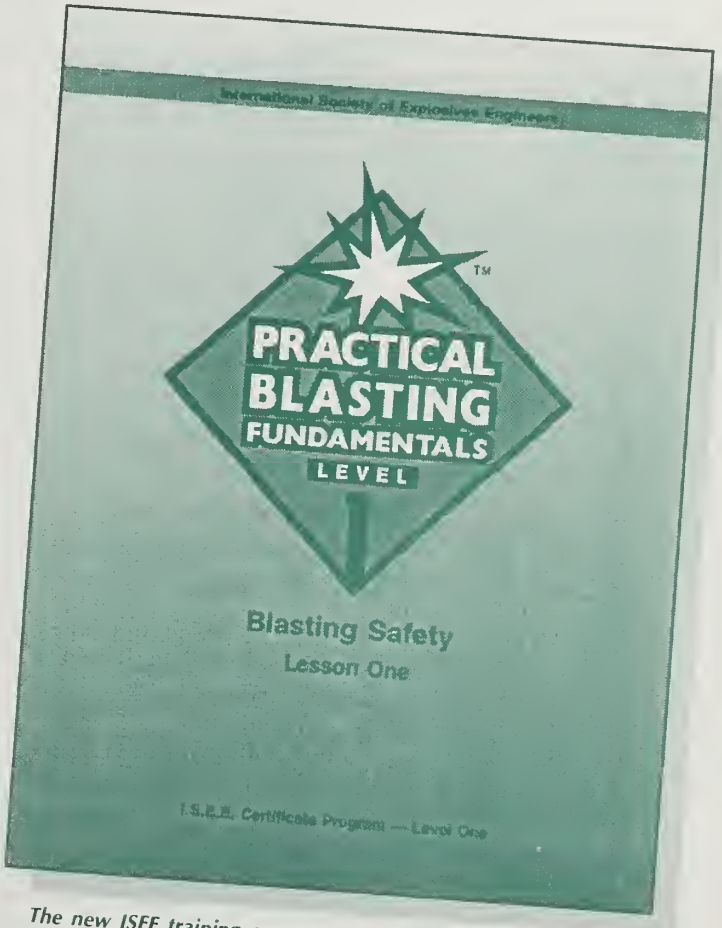
A new training course for personnel involved in blasting contracts has been edited and sent on computer disk to each Regional Blaster Examiner and Coordinator. A CD-ROM included with the disk contains publications from the Missoula and San Dimas Technology and Development Centers. Some of those publications are used in the training course. This training course, available from Regional Blaster Examiners, provides helpful information for anyone working with contracts involving explosives.



The anatomy of a blast hole.

International Society of Explosives Engineers (ISEE) Training

MTDC reviewed and critiqued the new training course, *Practical Blasting Fundamentals*—Level 1, offered by the International Society of Explosives Engineers. These eight video lessons will be integrated into the Forest Service general blaster's training program. Each Regional Blaster Examiner has the training course and videos for use at recertification classes. Additional videos and training booklets can be obtained from the International Society of Explosives Engineers in Cleveland, Ohio.



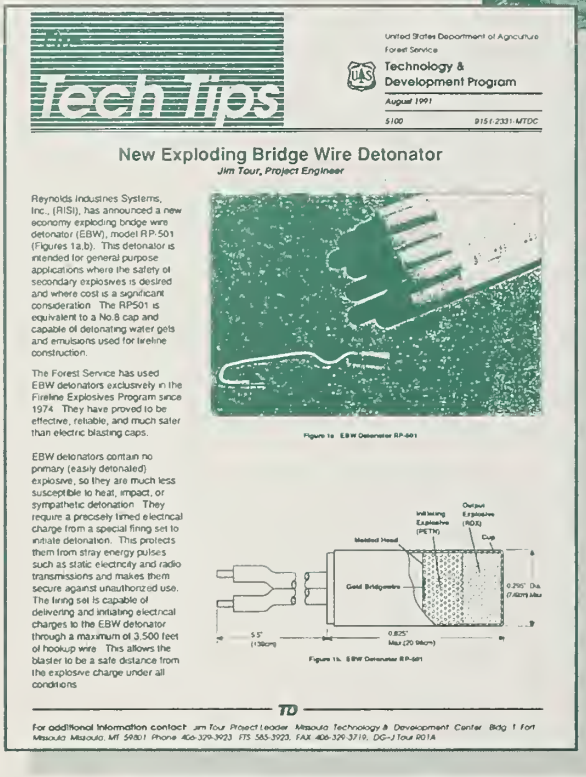
The new ISEE training course manual.

Fireline Explosives

Standard test procedures have been developed for the fireline explosives products used by all wildland firefighting agencies. MTDC continues to work with the U.S. Bureau of Mines and manufacturers in testing new fireline explosives products. Two fully qualified products are available, ETI's *Firebreak* and Austin's *Aqualine,* both of which have detonation cord running the entire length of the explosive. These products are no longer supplied on a reel—reducing their cost and packaged weight and improving their deployment time. MTDC also worked with Reynolds Industries Systems, Inc., to develop a new adapter that allows the FS-9 firing set to reliably initiate nonelectric shock tube detonating systems.

Demonstrating the use of fireline explosives for hazard tree removal.

Placing the exploding bridgewire into fireline explosives.



tech tips

United States Department of Agriculture
Forest Service
Technology & Development Program
August 1991
5100 9151-2331-MTDC

New Exploding Bridge Wire Detonator

Jim Tour, Project Engineer

Reynolds Industries Systems, Inc., (RISI), has announced a new economy exploding bridge wire detonator (EBW), model RP-501 (Figures 1a,b). This detonator is intended for general purpose applications where the safety of secondary explosives is desired and where cost is a significant consideration. The RP501 is equivalent to a No.8 cap and capable of detonating water gels and emulsions used for fireline construction.

The Forest Service has used EBW detonators exclusively in the Fireline Explosives Program since 1974. They have proved to be effective, reliable, and much safer than electric blasting caps.

EBW detonators contain no primary (easily detonated) explosive, so they are much less susceptible to heat, impact, or sympathetic detonation. They require a precisely timed electrical charge from a special firing set to initiate detonation. This protects them from stray energy pulses such as static electricity and radio transmissions and makes them secure against unauthorized use. The firing set is capable of delivering and initiating electrical charges to the EBW detonator through a maximum of 3,500 feet of hookup wire. This allows the blaster to be a safe distance from the explosive charge under all conditions.

Figure 1a. EBW Detonator RP-501

Figure 1b. EBW Detonator RP-501

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For additional information contact: Jim Tour, Project Leader, Missoula Technology & Development Center, Bldg. 1, Fort Missoula, Missoula, MT 59801. Phone: 406-329-3923, FTS: 585-3923, FAX: 406-329-3719, DG-J.Tour:R01A

Tech Tips are used to share information with Forest Service field employees.

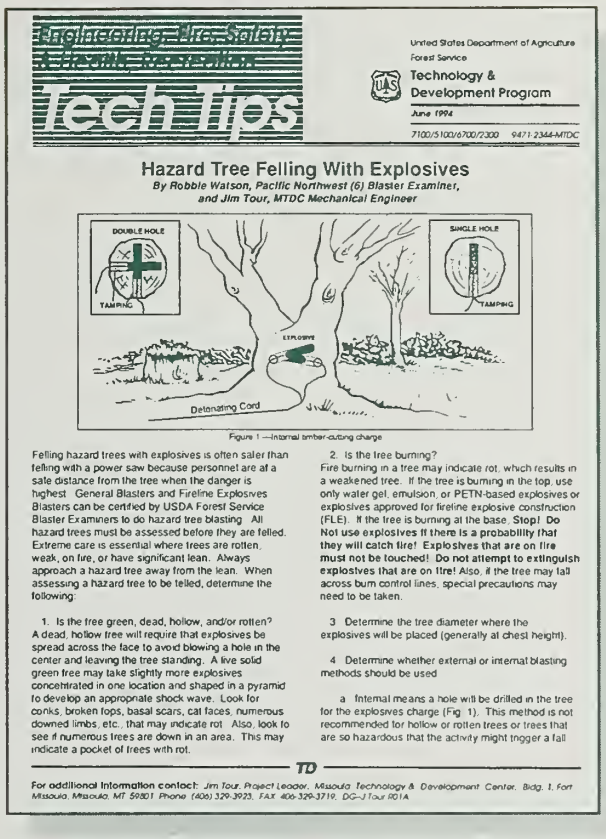
MTDC serves as the technical advisor for the Fireline Explosives Program. The Center is working on a standardized training and certification program and on standardized procedures for fireline explosives.

Hazard Tree Felling With Explosives

In 1994, MTDC published the *Hazard Tree Felling With Explosives* Tech Tip. It provides field personnel with information on safely felling hazard trees by placing explosives on a tree or inside a tree, provided the wood is solid.

More information was needed on felling hollow, rotten trees. MTDC conducted tests on the Avery District of the Idaho Panhandle National Forests during Fiscal Year 1996 to verify the rule of thumb that you should use "one wrap of fireline explosive for every inch of holding wood."

MTDC developed a slide program that can be used for training. The original Tech Tip must accompany the slide program because it is still valid for felling hazard trees when they have solid wood.



Engineering, Fire, Safety, Aviation, Transportation

tech tips

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Technology & Development Program
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7100/5100/6700/7300 9471-2344-MTDC

Hazard Tree Felling With Explosives

By Robbie Watson, Pacific Northwest (6) Blaster Examiner, and Jim Tour, MTDC Mechanical Engineer

Figure 1.—Internal timber-cutting charge

Felling hazard trees with explosives is often safer than felling with a power saw because personnel are at a safe distance from the tree when the danger is highest. General Blasters and Fireline Explosives Blasters can be certified by USDA Forest Service Blaster Examiners to do hazard tree blasting. All hazard trees must be assessed before they are felled. Extreme care is essential where trees are rotten, weak, on fire, or have significant lean. Always approach a hazard tree away from the lean. When assessing a hazard tree to be felled, determine the following:

1. Is the tree green, dead, hollow, and/or rotten? A dead, hollow tree will require that explosives be spread across the face to avoid blowing a hole in the center and leaving the tree standing. A live solid green tree may take slightly more explosives concentrated in one location and shaped in a pyramid to develop an appropriate shock wave. Look for conks, broken tops, basal scars, cat faces, numerous downed limbs, etc., that may indicate rot. Also, look to see if numerous trees are down in an area. This may indicate a pocket of trees with rot.

2. Is the tree burning? Fire burning in a tree may indicate rot, which results in a weakened tree. If the tree is burning in the top, use only water gel, emulsion, or PETN-based explosives or explosives approved for fireline explosive construction (FLE). If the tree is burning at the base, **Stop! Do Not use explosives if there is a probability that they will catch fire! Explosives that are on fire must not be touched! Do not attempt to extinguish explosives that are on fire!** Also, if the tree may fall across burn control lines, special precautions may need to be taken.

3. Determine the tree diameter where the explosives will be placed (generally at chest height).

4. Determine whether external or internal blasting methods should be used.

a. Internal means a hole will be drilled in the tree for the explosives charge (Fig. 1). This method is not recommended for hollow or rotten trees or trees that are so hazardous that the activity might trigger a fall.

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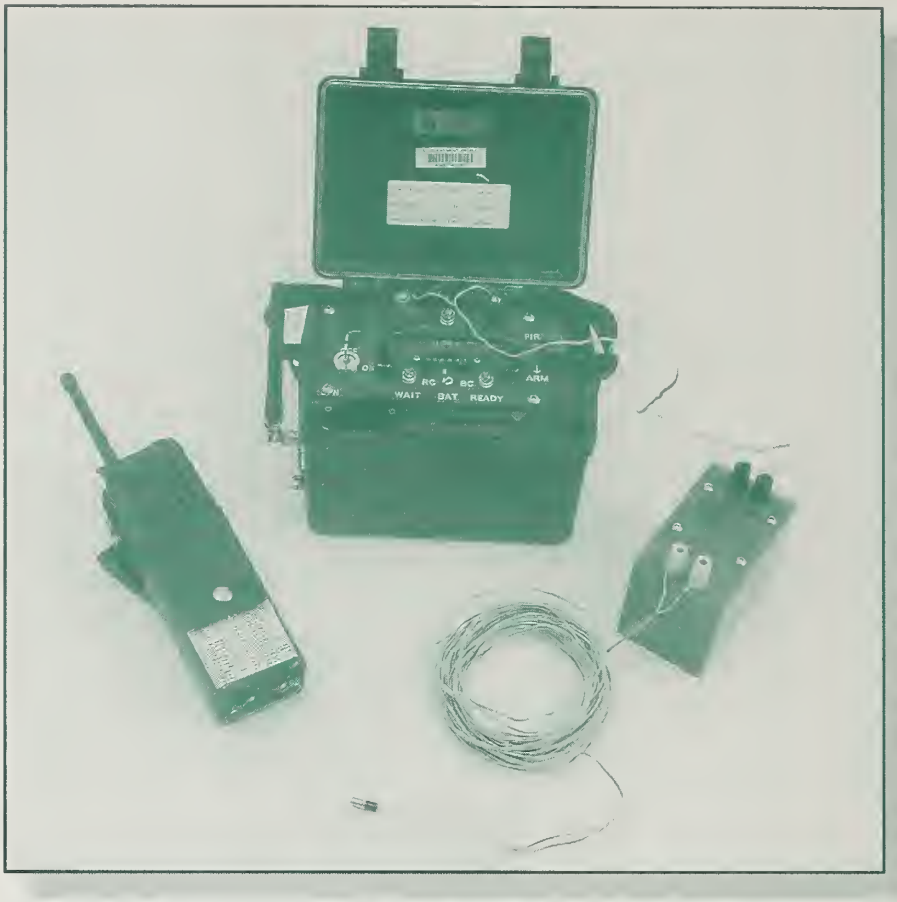
For additional information contact: *Jim Tour, Project Leader, Missoula Technology & Development Center, Bldg. 1, Fort Missoula, Missoula, MT 59801. Phone (406) 329-3923. FAX 406-329-3719. DG-J Tour R01A*

This Tech Tip helps field employees use fireline explosives to remove hazard trees that have solid wood.

With hollow trees, one wrap of fireline explosive is used for every inch of solid holding wood.

Remote Detonation System

At the request of Regional Blaster Examiners, MTDC completed development and evaluation testing of a radio-controlled detonation system for blasting operations. The new system eliminates the need for long lead wires that generally stretch 150 meters between the Blaster-in-Charge and the explosives charge. The system is capable of detonating electric blasting caps (EBC's), exploding bridgewire detonators (EBW's), or nonelectric detonators. The system is activated using the standard King radio used by the Forest Service. The remote detonation system allows the Blaster-in-Charge more flexibility in selecting a location to initiate the blast. This system has been approved for use in all blasting operations, including the fireline blasting program. A detailed report, *Remote Detonation System for Blasting* (9571-2821-MTDC), includes a list of component manufacturers and is available from MTDC.



The remote detonation system used with the exploding bridgewire detonator.

Boulder Buster

MTDC is evaluating a new device that uses a cartridge resembling a shotgun shell to break boulders, rocks, or concrete. The device, called a *Boulder Buster,* has a barrel that transmits a shock wave impulse from a cartridge through an incompressible fluid column

The Boulder Buster can break boulders, rocks, or concrete without explosives.

(water or gel) placed in a hole drilled in the rock. The device does not use explosives. Special certification is not required, training is minimal, and there are no special storage and transportation requirements for the cartridges. Field tests conducted in Fiscal Year 1997 will be reported in Fiscal Year 1998.

This boulder was split by the Boulder Buster.

Nonelectric (Nonel) Initiator Adapter

Two nonelectric initiator adapters have been developed to initiate a nonelectric shock tube (Nonel). They can be used with the FS-9 exploding bridgewire system, the remote detonator system, or any detonation system for electric blasting caps that uses more than 20 joules of power. MTDC developed a system that is a "spark plug," normally used on nonelectric initiators, that has been adapted with two electrical connectors wired directly from an adequate power source (firing device). The second system, developed by Reynolds Industries Systems, Inc., uses dummy EBW's encased in plastic to generate a spark that initiates a nonelectric shock tube. Information on either system can be obtained from the Center.

Nonelectric (Nonel) adapters used to initiate a nonelectric shock tube.

National Blasting and Explosives Program

Generally, each Forest has a designated Lead Blaster who can conduct blasting operations and review blast plans to ensure that operations are being conducted safely. Each Region has a Regional Blaster Coordinator and an Examiner who are responsible for the overall program (see FSM 6745). Forest Service personnel seeking more information regarding the Blasting and Explosives Program in their Region can contact:

Tom Donahue, Blaster Coordinator
USDA FS, R-1 Engineering
POB 7669, 200 East Broadway
Missoula, MT 59807

Mike Knodel, Blaster Examiner
USDA FS, Idaho Panhandle NF
3815 Schrieber Way
Coeur d'Alene ID 83814

Lois Bachensky, Blaster Coordinator
USDA FS, R-2 Engineering
POB 25157
Lakewood, CO 80225

Gene Quintana, Blaster Examiner
USDA FS, Rio Grande NF
1803 West Highway 160
Monte Vista, CO 81144

Jim Rawlinson, Blaster Coordinator
USDA FS, Southwestern Region
157 Gold Avenue SW
Albuquerque, NM 87102

Southwestern Region Blaster Examiner (vacant)

Larry Durk, Blaster Coordinator
USDA FS, Intermountain Region
325 25th Street
Ogden, UT 84401

Jerry Firth, Blaster Examiner
USDA FS, Boise NF
1750 Front Street
Boise, ID 83702

Tom Pestotnik, Blaster Coordinator
USDA FS, Pacific Southwest Region
630 Sansome Street
San Francisco, CA 94111

Jerry Harmon, Blaster Examiner
USDA FS, Shasta-Trinity NF
204 West Alma
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Portland, OR 97208

Robbie Watson, Blaster Examiner
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Glide, OR 97443

Loren Evens, Blaster Coordinator
USDA FS, Southern Region
1720 Peachtree Road NW
Atlanta, GA 30367

Gary McElroy, Blaster Examiner
USDA FS, Ozark-St. Francis NF
Box 1008, 605 West Main Street
Russellville, AR 72811

Bill Rees, Blaster Coordinator
USDA FS, Eastern Region
310 W. Wisconsin Ave., Room 500
Milwaukee, WI 563203

Jon Hakala, Blaster Examiner
USDA FS, Kawishiwi RD
118 South 4th Avenue East
Ely, MN 55731

Bill Hartzog, Blaster Coordinator
USDA FS, Alaska Region
Federal Office Bldg., Box 21628
Juneau, AK 99802-1628

Greg Overturf, Blaster Examiner
USDA FS, Alaska Region
204 Siginaka Way
Sitka, AK 99835

Doug Abromeit, Specialty Avalanche Blasting
USDA FS, Ketchum RD
P.O. Box 2356
Ketchum, ID 83340

Recent Documents

Disposing of Ammunition, Explosives, and Incendiaries, Tech Tip, 9767-2332-MTDC, September 1997

Remote Detonation System for Blasting, 9571-2821-MTDC, June 1995

Blasting Activities on the Tongass National Forest, Trip Report, 9571-2801-MTDC, November 1994

Hazard Tree Felling With Explosives, Tech Tip, 9471-2344, MTDC, June 1994

New Explosives for Trail Construction, Tech Tip, 9423-2315-MTDC, May 1994

Single copies of documents may be ordered from:

USDA Forest Service, MTDC
Building 1, Fort Missoula
Missoula, MT 59804-7294
Phone: (406) 329-3900
Fax: (406) 329-3719